

Section 2: Ecosystem Management Objectives

2.1 Ecosystem Alternative Selection

The Lake Erie ecosystem is managed by a variety of agencies with different responsibilities. There is a need to determine a set of goals and objectives for this ecosystem, consistent with the Lake Erie LaMP concept paper (U.S. EPA and Environment Canada 1995), so that agencies can co-ordinate their actions for effective management. Based on the results of extensive input and review, and the development of the Lake Erie ecosystem model (Colavecchia et al. 2000) a series of four alternative states for the future of Lake Erie has been identified (Lake Erie LaMP 2000).

This approach, which differs from that used for developing objectives for other Great Lakes, has resulted in a better understanding of which Lake Erie management actions impart the greatest effect and which components of the ecosystem are most directly impacted. The four ecosystem alternatives represent different levels of recovery of natural ecosystem form and function. The extent of recovery is dictated by the combination and strengths of various management interventions (Table 1).

Changes in land use that represent return towards more natural landforms or that mitigate impacts of urban, industrial and agricultural land uses, are the most significant actions that can be taken to restore the Lake Erie ecosystem. Alternative 3 represents moderate loss of natural landforms relative to status quo (Alternative 4), while Alternatives 1 and 2 represent small gains in the amount of natural landforms in the basin. Alternatives 3, 2, and 1 represent increasingly more progressive mitigation of agricultural, industrial and urban land use. The mitigation results in very strong reductions in phosphorus export from land, and in total suspended solids concentrations. The alternatives differ in the level of reduction of phosphorus exports from sewage treatment plants (STPs) with Alternative 2 requiring moderate reduction, Alternative 3 a strong reduction and Alternative 1 a very strong reduction.

The selection of an Ecosystem Alternative toward which to manage Lake Erie is not a trivial issue. There are many competing, and incompatible, uses of Lake Erie, and multiple agencies (federal, state, provincial and local) have jurisdictions over one or

Table 1: Summary of Lake Erie Ecosystem Alternatives

Management Lever or Effect	Action or Effect	Ecosystem Alternatives			
		1	2	3	4
Agricultural land use	Mitigation of impact	very strong	strong	strong	status quo
Industrial land use	Mitigation of impact	very strong	moderate	moderate	status quo
Urban land use	Mitigation of impact	very strong	strong	moderate	status quo
Natural landscapes	Restoration	small gain	small gain	moderate loss	status quo
Phosphorus concentration	Reduced concentrations in tributaries, nearshore and lake	very strong	strong	strong	status quo
Phosphorus from land	Reduction in loadings	very strong	very strong	very strong	status quo
Phosphorus from STPs	Reduction in loadings	very strong	moderate	strong	status quo
Total suspended solids	Reduction in concentration	very strong	very strong	very strong	status quo

more components of the ecosystem. Societal factors that influence the choice include economics, social justice, land use, and others. To be an effective tool, the LaMP, including the desired ecological state for Lake Erie, must have the support and commitment of the various environmental managers, decision makers and the public. Without a consensus on ecological conditions to be achieved, multiple management efforts could easily be competing, ineffective, and/or counterproductive. Ultimately, the process for choosing an Ecosystem Alternative for management purposes becomes one of identifying which one is most closely compatible with societal values of the residents in the basin.

The Lake Erie LaMP Work Group considered several options for soliciting opinions and comments on preferred Ecosystem Alternatives from government agencies, environmental groups, industry and the general public. Opinions were solicited through informal discussions, the Lake Erie Binational Public Forum, and agency reviews. In June 2001, the LaMP Work Group reached consensus that Ecosystem Alternative 2 would represent the preferred ecosystem of the Work Group. In September 2001, the LaMP Management Committee endorsed this conclusion. Additional discussions with stakeholders, including the public, are being held to present the selection of Ecosystem Alternative 2.

Ecosystem Alternative 2 is consistent with the themes of sustainable development and of multiple benefits to society of a healthy Lake Erie ecosystem. The analysis supporting Ecosystem Alternative 2 highlights the importance and urgency of improving land use activities, continued diligence in nutrient management, and the vulnerability of fish and wildlife species to human activities.



Photo: Upper Thames River Conservation Authority

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2.2 Selection of Ecosystem Management Objectives

Ecosystem management objectives are targets that, when all are achieved, should result in the preferred ecosystem alternative being realized. The Great Lakes Water Quality Agreement addresses the large areas of the lake and considers them homogenous when establishing phosphorus loading targets and target concentrations. A target concentration in western Lake Erie may be achieved while having large areas of highly enriched waters due to the effect of watersheds like the Maumee River. Eastern Lake Erie may be at target concentrations of phosphorus while the lower Grand River (Ontario) is highly enriched. Watersheds and their area of influence in the lake are the natural building blocks with which to strategize this new phase of ecosystem rehabilitation. The challenge for developing ecosystem objectives for the Lake Erie ecosystem lies in its distinct three basins, each with very different characteristics. As a result, ecosystem management objectives for the whole of Lake Erie may require the development of sub-objectives for each basin. There shall be substantial emphasis on watersheds and land use activities therein.

Ecosystem Alternative 2 does not prescribe the necessary management goals to realize the desired ecosystem. Management goals are dependent on the ecosystem management objectives formulated to be consistent with the Ecosystem Alternative, and are based on the present state of the ecosystem components. Input from the Lake Erie community on the preferred Ecosystem Alternative 2 helps define the degree of implementation that is necessary and acceptable to be consistent with the ecosystem alternative. Additional ecosystem management objectives, not explicitly defined through the ecosystem alternative selection, may also be identified as being important to the community.

The Lake Erie ecosystem has three very distinct basins, and within the entire watershed of the lake there are 34 sub-watersheds, many of which have unique features

and pressures. The impact of exotic species in the Lake Erie ecosystem contributes to instability, and new species continue to access the ecosystem. Implementation of the management strategies moves the ecosystem in the right direction, and leads to improvements in biological integrity. The process is iterative. Tracking of recovery in relation to management interventions leads to projections of reasonable and feasible endpoints for biological integrity at appropriate units of the ecosystem (i.e. watersheds and areas of influence in the lake, bays, basins).

The overall ecosystem management objectives are presented as principles for management actions to achieve Ecosystem Alternative 2. The objectives are presented in relation to the main management categories influencing the status of the lake: land use, nutrient management, natural resource exploitation and contaminants. In proposing these ecosystem management objectives, it is recognized that each watershed and basin may require varying degrees of implementation. Management sub-objectives provide the context for the degree of managerial actions that may be required to achieve the status of ecosystem elements expected under Ecosystem Alternative 2. The management sub-objectives are considered for the whole lake basin. Although each individual watershed may require greater or lesser degrees of management action, taken together, achievement of the management sub-objectives should lead to the attainment of the management objectives. The *status quo* or “current conditions” are generally reflective of conditions found in the mid-to-late 1990s. In the management sub-objectives presented below, descriptive adjectives are used to imply a relative degree of management intervention required¹.

2.2.1 Ecosystem Management Objectives, Sub-objectives and Rationale

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All land use activities within the basin result in gains in the quantity and/or quality of natural habitat to the extent that native biodiversity and community integrity can be realized to the greatest degree possible throughout the basin and be sustained for the benefit of future generations.

- o Strong reductions (from 1990s’ levels) of the impacts of land use on the structure and function of the Lake Erie ecosystem shall be achieved.
 - o The impacts of agricultural land shall be strongly mitigated by continuing reductions in the use of conventional tillage, agricultural chemicals and fertilizers.
 - o Conventional urban land use practices shall be strongly mitigated through implementation of environmentally friendly strategies.
 - o Conventional industrial land use practices shall be moderately reduced in impact through implementation of environmentally friendly strategies.
 - o Natural landscapes and habitats shall be maintained and small increases in natural landscape area should be realized, relative to the 1990s.

Rationale: Ecosystem Alternative analysis identified land use practices as the dominant management category affecting the Lake Erie ecosystem. Key elements within the category were gains in quality natural lands and environmentally sound management practices for rural, urban and industrial landscapes.

Best management practices (BMPs) can mitigate many deleterious land uses and their impacts to the extent that natural habitat quality and quantity can improve. It is expected that there will be increasing demands and pressures for land conversion in the Lake Erie basin. Proactive planning for these pressures needs to include the protection of critical habitat corridors that connect and link habitats between the lake,

¹ Adjectives were derived from differences in the model results for Ecosystem Alternative #2 relative to conditions in the 1990s: slight (% < 10), small (11 < % < 20), moderate (21 < % < 40), strong (41 < % < 60), very strong (61 < % < 80), major (% > 80). % does not necessarily translate directly into acreage, biomass, or other units but provides a relative, qualitative guide to the difference between conditions for Ecosystem Alternative #2 and those of the 1990s (Colavecchia et al., 2000)

the wetlands and the upland habitat. Specific watershed targets need to be established, which include securing, protecting and restoring natural lands. A watershed approach is critical to developing local solutions and to maximizing gains with partners.

“Best Management Practices” (BMPs) are mitigating strategies that are crosscutting and invaluable to achievement of all of the objectives. Agricultural “BMPs” create natural land habitat and wildlife corridors, and protect aquatic habitat and fisheries. If soil particles are not trapped by buffer strips and prevented from entering watercourses, they degrade aquatic habitat as silt and suspended solids, and they have carried nutrients, pesticides and contaminants with them. Widespread implementation of agricultural BMPs is critical to achievement of objectives. Greening strategies for urban and industrial landscapes have similar benefits and all contribute to reduced “flashiness” of stream flows.



Photo: Upper Thames River Conservation Authority

Nutrients

Nutrient inputs from both point and non-point sources shall be managed to ensure that loadings are within bounds of sustainable watershed management and consistent with ecosystem requirements as described in Ecosystem Alternative 2.

- o Total phosphorus loadings may be moderately reduced below the GLWQA maximum allowable rate of 11,000 metric tons/year.
- o Phosphorus export from non-point sources, including agricultural land use, in accordance with the alternative, is to be very strongly reduced in order to favor recovery and maintenance of healthy aquatic communities in the immediate receiving waters.
- o Sewage treatment plants may be acted on to discharge phosphorus at a concentration moderately below the GLWQA rate of 1 mg/l.

Rationale: It is important that all sources that contribute to the watershed nutrient load and ultimately to the basin load, be managed to limit local and regional impacts. Best management practices and point source controls need to be implemented with consideration of the ecological requirements for the maintenance or recovery of healthy aquatic communities in the watershed, the hydrologic cycle and water usage. Other nutrients and their various forms, such as nitrates, need to be included in assessments of watershed and basin impacts.

Exploitation

Exploitation and disturbance of aquatic and terrestrial species shall be managed to ensure that the integrity of existing healthy communities be maintained, providing benefits to consumers. In addition, exploitation and disturbance should be managed to ensure that these factors do not prevent recovery of degraded communities, to the extent

allowed by habitat. The harvest of valued timber resources, extraction of aggregate deposits and the utilization of other features of the working landscape should be done in a manner that is sustainable and that affords the greatest opportunity to preserve and enhance the biological context integrity of the Lake Erie ecosystem.

- o Disturbance of wildlife by human activities (boating, hiking, etc.) shall be substantially reduced from levels during the 1990s.
- o Fishing shall be maintained at sustainable levels recommended in the Fish Community Goals and Objectives for Lake Erie for the 1990s (Lake Erie Committee 2002).

Rationale: Commercial and sport fishing, hunting, trapping, and disturbance by human presence or activity have negative impacts on target species and habitats and more broadly on other components of the ecosystem. Integrity is a general term for the recurring structure and composition of a community over time, due to internal regulation. Fisheries managers look to top order predators to provide this regulation in aquatic communities and, for example, are managing walleye in recognition of their ecological role as well as a capacity to provide a valuable fishery.

Sustainable management of timber stands can realize harvest of valued trees for present and future generations and still maintain essential habitat function. Resource extraction is recognized as valued economic activity but should be done in a manner to prevent or mitigate to the greatest extent possible the negative environmental impacts.

Contaminants

In order to achieve Ecosystem Alternative 2, toxic chemical and biological contaminant loadings within the basin must decline to a level that would permit sustainable use of natural resources.

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- o Toxic substances shall not exist in amounts to the detriment of human health or wildlife.
- o Exotic species should be prevented from colonizing the Lake Erie ecosystem and controlled where feasible and consistent with other objectives. Exotic species shall be reduced to a point where they do not impair the ecological function of the Lake Erie ecosystem.

Rationale: The amount of toxic contaminants in the Lake Erie ecosystem is the result of the combined inputs from point and non-point sources within the basin, loadings from the Detroit River, and upstream and long-range transport from regional and global sources. Degraded watersheds not only impact local fauna, but they can have lakewide impacts, particularly if used by fish for spawning or nursery habitat. Effective management of local point and non-point sources can improve watershed and basin ecosystem quality. However, broad based actions such as those promoted in the Great Lakes Binational Toxics Strategy and the United Nations Agenda 21 (addressing global atmospheric pollutant transport) are also required to fully reach this objective.

Biological contaminants, defined as species exotic to the Lake Erie ecosystem, are the result of intentional or unintentional introductions, or range expansion and colonization. The LaMP has identified exotic species as one of the key problems impairing the Lake Erie ecosystem. Successful invaders may prey upon native species or compete with them for limited resources, altering the structure of the local and lakewide ecosystems. The impact of exotics needs to be minimized where feasible by preventing access, and controlling or managing them once they have entered the ecosystem.

The Lake Erie ecosystem management objectives assume that toxic contaminant loadings are managed according to the principles of virtual elimination. As such, levels of contaminants should be declining, not be present at varying levels, and not be controlling other ecosystem components.

2.3 Indicators

Indicators are measurable features that identify the current state of the ecosystem relative to the desired state. The desired state is defined through the ecosystem management objectives, which are compatible with the modeled results as expressed in the Ecosystem Alternative. Indicators shall be identified to track progress toward the ecosystem management objectives.

A set of Great Lakes indicators has been, and is continuing to be, developed through the State of the Lakes Ecosystem Conference (SOLEC) process, and biennial assessments of the condition of Lake Erie ecosystem components are being made. To the extent possible, indicators for the Lake Erie ecosystem objectives shall reflect those for SOLEC reporting. However, Lake Erie has many unique features that may require specific indicators not included in the SOLEC set. In other cases, the indicators may be similar, but the target or desired end-state may be unique for Lake Erie.

Currently over 90 surveillance and monitoring programs are underway in the Lake Erie basin. To the maximum extent possible, Lake Erie Ecosystem Alternative Indicators shall utilize these existing programs to track progress.